

CLAIMS:

1. A mass spectrometer including
a plasma ion source for providing analyte ions,
5 a mass analyser,
an interface between the plasma ion source and the mass analyser,
the interface comprising a structure which separates a first region at a
relatively high pressure which receives plasma from the plasma ion source from
a second region at a relatively low pressure leading to the mass analyser and
10 which provides an aperture between the first higher pressure region and the
second lower pressure region through which the plasma flows from the higher
pressure region towards the lower pressure region,
the interface structure including a passage for supplying a substance into
the aperture for interaction with the plasma for attenuating polyatomic or
15 multicharged interfering ions by reactive or collisional interactions.
2. A mass spectrometer as claimed in claim 1 wherein the interface
comprises a sampling cone followed by a skimmer cone, wherein said structure
is the skimmer cone which includes the passage for supplying a substance into
20 its aperture.
3. A mass spectrometer as claimed in claim 1 wherein the interface
comprises a sampling cone followed by a skimmer cone, wherein said structure
is the sampling cone which includes the passage for supplying a substance into
25 its aperture.
4. A mass spectrometer as claimed in claim 2 wherein the sampling cone
includes a passage for supplying a substance into its aperture for interaction
with the plasma for attenuating polyatomic or multicharged interfering ions by
30 reactive or collisional interactions.
5. A mass spectrometer as claimed in any one of claims 2 to 4 including
electrode means following the skimmer cone for extracting an ion beam
containing analyte ions from the plasma for transmission to the mass analyser,

- the electrode means including at least one electrode which is configured and associated with the skimmer cone such that the portion of the relatively low pressure region between the skimmer cone and the at least one electrode will have a relatively higher pressure than the pressure elsewhere within said
- 5 relatively low pressure region thereby to provide a collisional gas volume for assisting the attenuation of polyatomic or multicharged interfering ions.
6. A mass spectrometer as claimed in claim 5 wherein the at least one electrode includes a passage for supplying a substance into an aperture of the
- 10 at least one electrode for interaction with the plasma for attenuating polyatomic or multicharged interfering ions by reactive or collisional interactions.
7. A mass spectrometer as claimed in any one of claims 2 to 6 wherein the skimmer cone includes an additional passage for supplying an additional
- 15 substance into its aperture for interaction with the plasma for attenuating polyatomic or multicharged interfering ions by reactive or collisional interactions.
8. A mass spectrometer as claimed in any one of claims 4 to 7 wherein the sampling cone includes an additional passage for supplying an additional
- 20 substance into its aperture for interaction with the plasma for attenuating polyatomic or multicharged interfering ions by reactive or collisional interactions.
9. A mass spectrometer as claimed in any one of claims 1 to 8 wherein the aperture or apertures through which the plasma flows and into which the
- 25 substance for interaction with the plasma is supplied is parallel-walled and relatively long for promoting extra collisions.
10. A mass spectrometer as claimed in any one of claims 1 to 8 wherein the aperture or apertures through which the plasma flows and into which the
- 30 substance for interaction with the plasma is supplied has a diameter which increases stepwise in the direction of flow of the plasma for lessening clogging of the aperture by solids deposited from the plasma.

11. A mass spectrometer as claimed in any one of claims 1 to 8 wherein the aperture or apertures through which the plasma flows and into which the substance for interaction with the plasma is supplied is tapered outwardly in the direction of flow of the plasma for lessening clogging of the aperture by solids
5 deposited from the plasma.
12. A mass spectrometer as claimed in any one of claims 1 to 8 wherein the interface structure includes means for producing a shock wave in the region of the aperture or apertures where the reactions or collisions occur to promote the
10 rate of reactions or collisions that remove interfering ions.
13. A mass spectrometer as claimed in claim 12 wherein the means for producing a shock wave comprises a flat surface surrounding the aperture or apertures.
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14. A mass spectrometer as claimed in claim 2 or 3 wherein the passage for supplying a substance into the aperture has an outlet which is located and configured for inducing a shock wave in the region of the aperture to promote the rate of reactions or collisions for improving the attenuation of interfering
20 ions.
15. A mass spectrometer as claimed in claim 2 or 3 wherein the passage for supplying a substance into the aperture has an outlet which is located and configured for a substance supplied therethrough to exit the passage in
25 substantially the same direction as the plasma flow through the aperture.
16. A method for plasma mass spectrometry including generating a plasma containing analyte ions,
substantially confining the plasma radially whilst flowing it from a higher
30 pressure region towards a lower pressure region,
supplying a substance directly into the substantially radially confined plasma to cause reactive or collisional interactions with polyatomic or multicharged interfering ions therein and thereby attenuate such polyatomic or multicharged ions, and

extracting an ion beam from the plasma for mass analysis of the analyte ions.

17. A method for plasma mass spectrometry as claimed in claim 16 wherein
5 the substance is supplied into the substantially radially confined plasma so as to create a shock wave in the plasma to promote the rate of reactions or collisions for improving the attenuation of interfering ions.
18. A method for plasma mass spectrometry as claimed in claim 16 wherein
10 the substance is supplied into the substantially radially confined plasma so as to cause substantial stagnation of the radially confined plasma without inducing a shock wave therein for increasing the residence time of the plasma whilst it is radially confined for improving the attenuation of interfering ions.
19. A method for plasma mass spectrometry as claimed in claim 16 wherein
15 the substance is supplied into the substantially radially confined plasma so as to have a substantially zero radial speed component and an axial speed component substantially in the same direction as the plasma flow.
20. A method for plasma mass spectrometry as claimed in claim 19 wherein
20 the axial speed component is substantially the same speed as the plasma.
21. A method for plasma mass spectrometry as claimed in any one of claims
25 16 to 20 wherein the plasma is generated in argon and the supplied substance is hydrogen.
22. A sampling cone for a plasma ion source mass spectrometer, the
sampling cone having an aperture at its apex and including a passage having
an outlet at the aperture for supplying a substance into the aperture, the
30 substance being for interaction with plasma flowing through the aperture.
23. A skimmer cone for a plasma ion source mass spectrometer, the
skimmer cone having an aperture at its apex and including a passage having

an outlet at the aperture for supplying a substance into the aperture, the substance being for interaction with plasma flowing through the aperture.